Development of Method of Layers Removing from the CdTe and $Zn_xCd_{1-x}Te$ Surfaces by the $K_2Cr_2O_7$ – HBr – Lactic Acid Etchants

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The purpose of this work is to develop the method of layers removing from the CdTe and $Zn_xCd_{1-x}Te$ surfaces by the $K_2Cr_2O_7$ – HBr – lactic acid (LA) etchants. Single crystals of CdTe and $Zn_{0,1}Cd_{0,9}Te$, which have been grown by Bridgman method, and $Zn_{0,04}Cd_{0,96}Te$ obtained from the gas phase were used for experiments. Preliminary surface treatment of semiconductors consisted of the following steps: ***grinding of the plates*** by abrasive powders M10-M1 (3-5 min) → ***mechanical polishing*** with diamond paste (3-5 min) → ***chemical etching to remove the damaged layer*** (80-100 μm) by the HNO_3 – HBr – $C_4H_6O_6$ etchants compositions → ***finishing chemical-dynamic polishing*** (CDP) by new slow etchants ($\mathbf{v_{pol}}$ = 0,1-3,8 μm/min).

Finishing step is the process of CDP using the method of disc rotating at T = 284 K and disk rotation speed $\gamma = 82\ min^{-1}$. The etchants were prepared using 40 % HBr, 10,9 % $K_2Cr_2O_7$ and 80 % LA. A certain amount of viscosity modifier – LA ($C_3H_6O_3$) was added to the etchants for obtaining low rate of CDP of CdTe and $Zn_xCd_{1-x}Te$ supporting a polishing effect. This can partially regulate the interaction of HBr and $K_2Cr_2O_7$ with evolving of Br_2 and promotes the better dissolution of interaction products of etchant with crystals.

The dependence of the CDP rates of the CdTe and $Zn_xCd_{1-x}Te$ versus solutions concentration, mixing, temperature, nature of material has been established. As the Zn content in the $Zn_xCd_{1-x}Te$ solid solution increases, $\mathbf{v_{pol}}$ increases and the surface polishing quality improves. It is recommended to remove the layers from the surface with polishing using next solutions (vol. %):
CdTe – (20-46) $K_2Cr_2O_7$: (20-46) HBr : (7-60) LA; ($\mathbf{v_{pol}}$ =0,1-3 μm/min);
$Zn_{0,04}Cd_{0,96}Te$ – (20-24) $K_2Cr_2O_7$: (20-80) HBr : (0-60) LA; ($\mathbf{v_{pol}}$ =0,2-3,5 μm/min);
$Zn_{0,1}Cd_{0,9}Te$ – (20-39) $K_2Cr_2O_7$: (20-54) HBr : (22-60) LA; ($\mathbf{v_{pol}}$ =0,1-3,8 μm/min).

After CDP, the samples must be washed by the next technological scheme: ***30 s 0,1 M $Na_2S_2O_3$ + 1 min H_2O + 2 min H_2O + 1 min H_2O*** (at T = 294 K). Plates can be stored in DMF for several weeks. The results of metallographic and profilometric analysis of surfaces after finishing CDP showed that etched semiconductor surfaces are characterized by high quality ($\boldsymbol{R_z}$ <0,05 μm) and good luster. Optimized composition and technological modes of surface treatment can be used for controlled removal of layers, chemical treatment of films and finish polishing of the surface of CdTe and $Zn_xCd_{1-x}Te$.